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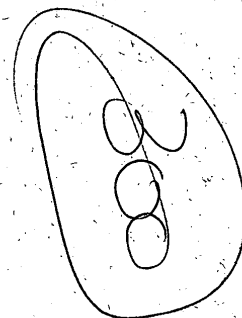
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basic imagery interpretation report

Chinese Troposcatter Communications Network (S)

DEPLOYED COMMO/ELEC/RADAR FACILITIES

BE: Various
CHINA



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CHINESE TROPOSCATTER COMMUNICATIONS NETWORK (S)**INTRODUCTION**

1. (TSU) An ultra-high frequency (UHF) troposcatter communications network is being constructed throughout China. Eighteen installations have been identified as troposcatter stations through joint analysis of photographic intelligence (photint) and signal intelligence (sigint) from 1972 through 20 October 1982. [REDACTED]

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[REDACTED] Although gaps exist between some of the 18 installations, this UHF troposcatter network (Figure 1) will greatly enhance Chinese command, control, and communications capabilities.

2. (TSZU) This report includes background information on the research and development of tropospheric telecommunications, Chinese use of imported electronics equipment, and a description of the 18 troposcatter stations that constitute the basis for a troposcatter network. These stations are:

Installation Name	BE No	Geographic Coordinates
Beijing Suspect R and D Electronics Facility	[REDACTED]	39-47-15N 116-09-20E
Dongping Troposcatter Station	[REDACTED]	36-00-08N 116-17-01E
Fangshan Radcom and Troposcatter Station	[REDACTED]	39-41-30N 115-56-24E
Guangzhou Troposcatter Station	[REDACTED]	23-12-50N 113-26-05E
Guyang Probable Troposcatter Station	[REDACTED]	40-59-20N 109-58-10E
Huo-shih-pa Probable Troposcatter Station	[REDACTED]	41-01-40N 112-38-30E
Jinan Troposcatter Station	[REDACTED]	36-36-10N 116-59-00E
Jinghou Troposcatter Station Northeast	[REDACTED]	41-17-04N 121-03-30E
Jinxian Troposcatter Station East	[REDACTED]	39-06-25N 121-46-30E
Li-chia-chai Troposcatter Station	[REDACTED]	31-47-46N 114-04-35E
Mashenqiao Troposcatter Station	[REDACTED]	40-10-28N 117-34-11E
Nanjing Troposcatter Station	[REDACTED]	32-08-04N 119-04-31E
Nanyue Troposcatter Station North	[REDACTED]	27-17-22N 112-41-18E
Qingyuan Troposcatter Station	[REDACTED]	42-09-20N 124-41-20E
Tung-shih Troposcatter Station	[REDACTED]	18-49-46N 109-31-38E
Xining Troposcatter Station	[REDACTED]	36-33-26N 101-33-13E
Zhanjiang Troposcatter Station	[REDACTED]	21-10-10N 110-17-45E
Zhenchang Troposcatter Station	[REDACTED]	39-47-48N 115-35-29E

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In addition, the following topics are discussed: the relationship of the troposcatter network to the national radio relay (radrel) system, possible troposcatter associations at four stations, [REDACTED]

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3. (TSZ) The information in this report lays the foundation for a study of the Chinese troposcatter communications network. The 18 identified troposcatter stations do not constitute a complete system. Footings for new probable troposcatter antennas, orientations of existing antennas, and [REDACTED]

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DISCUSSION

4. (S/WN) Troposcatter communications have been in use since the mid-1950s. The United States began its first operational troposcatter system in 1955;⁴ since then the Soviets have established a troposcatter network throughout the Soviet Union.⁵ Troposcatter networks are cost-effective in areas where long distances and rugged terrain need to be bridged by communications. Relay stations (repeaters) can be spaced up to 800 kilometers (km) apart, preventing the need for extensive access roads and reducing construction and maintenance costs associated with more conventional line-of-sight microwave communications systems. Troposcatter antennas are mounted in pairs oriented in the same direction and separated for space diversity to avoid signal interference. Paired antennas insure reliability when scattering the microwave signal into the troposphere, which is approximately 16 km above the surface of the earth. The troposphere is a turbulent atmospheric region of gases with different pressures, humidities, and velocities relative to one another. As the microwave signal travels through this varying medium, small amounts of energy are refracted, diffracted, and diffused. This scattered energy can be detected up to 4 degrees from the main signal direction by a pair of similarly designed receivers. Antenna design is a factor in positioning relay stations, which are normally 300 to 700 km apart.^{4,5}

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5. (S) [] The Chinese apparently began experimenting with troposcatter communications in the early 1960s. Scientists at the Shanghai Research Institute of Communications and the Jiatong University designed a klystron for an electron gun in 1960.⁶ The klystron is used as a high-power amplifying device required to transmit troposcatter signals; development of the highly sophisticated technology for the klystron caused the delay in the Chinese troposcatter communications effort.

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6. (TSZ) An extensive study of Chinese troposcatter stations has revealed a change in their design and construction. In the early 1970s, the Chinese experimented with truck-mounted cut-parabolic dish antennas near Luda in the Shenyang Military Region (MR) and Yantai in the Jinan MR.⁷ In 1974, the Chinese began testing parabolic dish antennas at Beijing Suspect Radar Electronics Facility. Two [] meter-diameter parabolic dish antennas were mounted on lattice towers near the edge of the facility. These antennas are similar to the Japanese OH-2000 communications system that operates in the 1.7 through 2.6 gigahertz (GHz) frequency range.⁸ The Japanese also produced parabolic dish antennas in the []-diameter sizes similar to the troposcatter antennas that have been observed along ridgelines in China.

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[] However, troposcatter stations in the western provinces have not yet been identified on imagery. There are two possible reasons for this. First, the Chinese may have transportable communications systems that can be erected, operated in time of need, and then dismantled. The mobility of the transportable system could account for the multiple sigint intercepts. Second, there has been a lack of imagery during the time of signal intercepts. The number of intercepts from unidentified facilities along Chinese borders also suggested that the Chinese used the same transportable troposcatter system to locate predetermined topographic sites for future expansion of the national troposcatter communications network between the border provinces and the national network in time of national emergencies.

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8. (S/WN) The Chinese normally use [] diameter parabolic dish antennas except for one station which has [] billboard-type antennas and one station with probable [] wide cut parabolic dish antennas. Parabolic dish antennas are capable of operating for distances as far as 600 km station to station, while the billboard type are capable of operating as far as 800 km station to station. The Chinese also have a troposcatter unit that is probably transportable consisting of two [] parabolic dish antennas mounted on metal lattice supports.⁹ Associated equipment for this unit includes two cargo trucks, two electronics van trucks, two generator trailers, and one small tent. A transportable troposcatter unit was deployed in 1976 at Hekou Troposcatter Station; the unit was removed later in the year and has not returned. Since 1976, the vacant site has been unchanged, suggesting possible reoccupation by a transportable unit.

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9. (S/WN) The 18 troposcatter stations (Table 1) represent ten years of progress and experimentation in both technology and selection of predetermined locations for a troposcatter network. In most cases, the Chinese have selected the highest elevations in a surrounding area to erect their antennas. In the original troposcatter stations, they used the []-diameter parabolic dish antennas to establish a network. However, in later years, it was obvious that the Chinese had progressed in technology as they selected a mixture of [] parabolic dish antennas for their troposcatter communications network. The [] parabolic dish antennas are still used at older sites and also appear to be used for transportable stations; however, the majority of the stations now use [] parabolic dish antennas.

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DESCRIPTION

Troposcatter Stations

10. (S/WN) **Qingyuan Troposcatter Station** (Figure 3), 32.8 km northwest of Qingyuan, is a road-served, mountaintop communications facility with one revetted control building, two support buildings, and two []-diameter parabolic dish troposcatter antennas oriented [] toward Jinghou Troposcatter Station Northeast.

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11. (S/WN) **Jinghou Troposcatter Station Northeast** (Figure 4) is 19.2 km northeast of Jinghou and consists of a mountaintop operations area and a support area in the valley below. The operations area includes three pairs of [] wide slotted-concrete revetments oriented [] The revetments oriented at [] each contain one [] parabolic dish antenna with corresponding orientation. The [] pair of revetments are empty; because they are

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Table 1.
Facilities in Troposcatter Network
(Items keyed to Figure 1)

Item (Figure Nos)	Name/ BE No/ Coordinates	Type of Antennas	Orientation Degrees	Recipient Station
1 (3)	Qingyuan Troposcatter Station 42 09 20N 124 41 20E	Two [] parabolic dish		Jingzhou Trope Station NE
2 (4)	Jinshu Troposcatter Station NE 41 17 04N 121 03 30E	Four [] parabolic dish (two pairs)		Qingyuan Trope Station Mashengqiao Trope Station*
3 (5)	Zhenchang Troposcatter Station 39 47 48N 115 35 28E	Two [] parabolic dish		Jinan Trope Station
4 (6)	Jinan Troposcatter Station 36 36 10N 116 59 00E	Two [] parabolic dish		Zhenchang Trope Station
5 (7)	Huoshihai Probable Troposcatter Station 41 01 40N 112 38 30E	Two [] billboard type		Not known
6 (8)	Beijing Suspect R and D Electronics Facility 39 47 15N 116 09 20E	Two [] parabolic dish		++
7 (9)	Guang Probable Troposcatter Station 40 59 20N 109 58 10E	Two prob[] out- parabolic dish		Not known***
8 (10)	Jinwan Troposcatter Station East 39 06 25N 121 48 30E	Two [] parabolic dish		Wefang Jinan MR
9 (11)	Tung-shih Troposcatter Station 18 49 46N 109 31 38E	Two [] parabolic dish		Zhanjiang Trope Station
10 (12)	Zhanjiang Troposcatter Station 21 10 10N 110 17 45E	Two [] parabolic dish and two parabolic dish		Guangzhou Trope Station Tung-shih Trope Station
11 (13)	Guangzhou Troposcatter Station 23 12 50N 113 26 05E	Two [] parabolic dish		Zhanjiang Trope Station
12 (14)	Nanyue Troposcatter Station North 27 17 22N 112 41 18E	Two [] parabolic dish		Guilin (no known trope station)
13 (15)	Nanjing Troposcatter Station* 32 08 04N 119 04 31E	Two [] billboard type		Dongging Trope Station
14 (16)	Fangshan Radcom and Troposcatter Station 39 41 30N 115 58 24E	One [] parabolic dish		++
15 (17)	Li-Chia-Chai Troposcatter Station 31 47 46N 114 04 35E	Two [] parabolic dish		Luoyang Army Bks AL 1
16 (18)	Xining Troposcatter Station 36 33 26N 101 33 13E	Two [] parabolic dish		Lanzhou city
17 (19)	Dongging Troposcatter Station 36 00 08N 116 17 01E	Two [] parabolic dish		Nanjing Trope Station
18 (20)	Mashengqiao Troposcatter Station 40 10 28N 117 34 11E	Four [] parabolic dish mounted in pairs		Ukn station prob near Wefang in Jinan MR. Jingzhou Trope Station NE

[] Jevietment empty, probably oriented to Simuju, North Korea
** Antennas not operational, oriented in 2 different directions
*** Antennas possible
* Station under construction
** Previously reported troposcatter dishes dismantled in 1976, one parabolic dish reinstalled in 1981

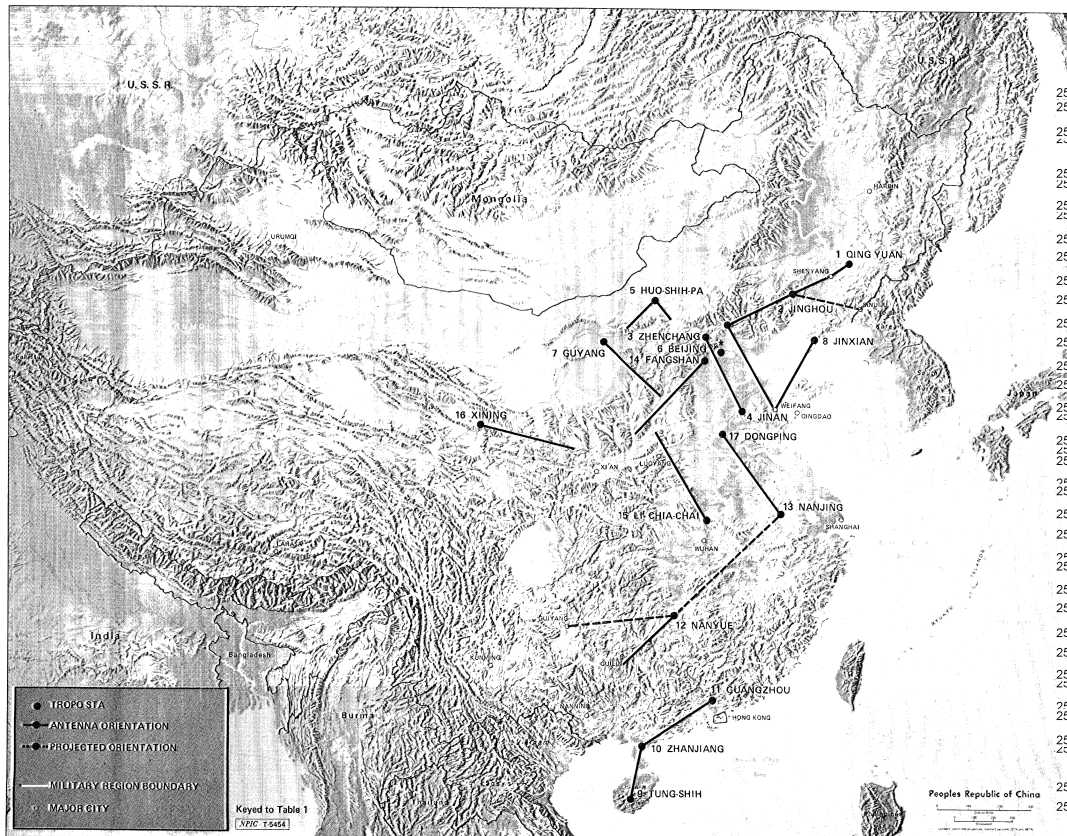


FIGURE 1. CHINESE TROPOSCATTER NETWORK



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oriented toward Sinuiju, North Korea, they are the probable link for international transmissions from North Korea. Sinuiju is the western terminal for the North Korea International Radrel Microwave Communications Network. The [] revetment/antennas are oriented toward Qingyuan Troposcatter Station. The antennas oriented [] may be pointed at Mashenqiao Troposcatter Station. The Jinghou station also includes three adits in the nearby hill, suggesting an elaborate underground switching center.

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12. (S/WN) **Zhenchang Troposcatter Station** (Figure 5), 29.6 km west of Fang-shan, consists of a road-served, mountaintop troposcatter station containing one revetted control building, two support buildings, and two []-diameter parabolic dish antennas oriented [] toward Jinan Troposcatter Station..

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13. (S/WN) **Jinan Troposcatter Station** (Figure 6) is 5.6 km south of Jinan. It consists of a road-served, hilltop troposcatter station containing an operations area with one control building, five support buildings, two []-meter-diameter parabolic dish antennas oriented [] and two small horizontal dipole antennas. The station also includes a support area located in the valley below containing 15 assorted support buildings. The two []-meter parabolic dish antennas are oriented toward Zhenchang Troposcatter Station.

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14. (S/WN) **Huo-shih-pa Probable Troposcatter Station** (Figure 7), collocated with Huo-shih-pa TV Relay Station Northwest [] is 4.8 km west-northwest of Huo-shih-pa. It comprises a road-served, hilltop communications station and a television relay station containing one control building, nine assorted support buildings, two [] billboard-type antennas, and a self-supporting lattice tower with VHF/UHF television antennas mounted on the top. The two oddly configured billboard-type antennas are oriented 145 and 230 degrees; neither of the azimuths intersect other known troposcatter stations. In April 1976, the station also included two pairs of PM-24/28 microwave antennas, but they have been removed. The status of this station is not clear. []

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[] It is possible that the Chinese sporadically use this site to operate their transportable troposcatter equipment.

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15. (TSZU) **Beijing Suspect Research and Development Electronics Facility** (Figure 8) is 21.1 km southwest of the center of Beijing. The road-served facility consists of multiple test pad testing areas for electronics-associated equipment and includes two [] high, self-supporting lattice towers with [] diameter parabolic dish antennas. The nonaligned antennas were oriented in two separate directions in September 1982. In May 1979, the antennas were oriented at approximately [] toward Jinghou Troposcatter Station Northeast. The two antennas are similar to a Japanese OH-2000 troposcatter system that the Chinese had purchased. []

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16. (S/WN) **Guyang Probable Troposcatter Station** (Figure 9) is 7.0 km southwest of Guyang. It consists of a wall-secured compound containing one control building and two probable [] wide cut-parabolic dish antennas oriented 160 degrees. The possibility exists that the antennas are [] diameter parabolic dish antennas rather than cut parabolic. No known corresponding facility is associated with this station. []

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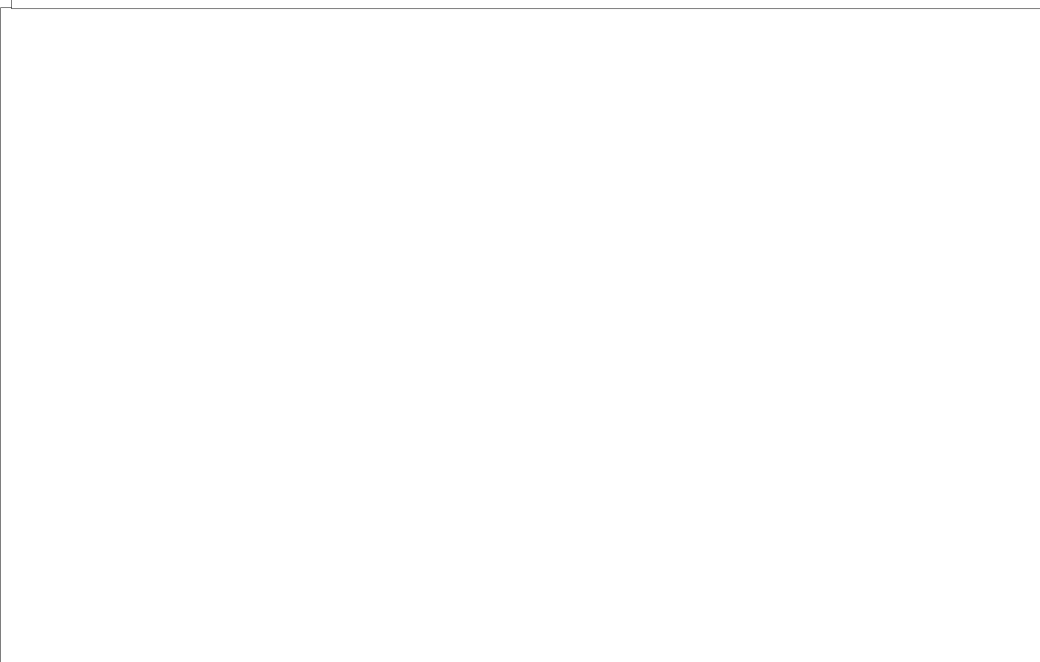
17. (TSZU) **Jinxian Troposcatter Station East** (Figure 10) is 9.1 km east of Jinxian. It consists of one, large, multistory operations/control building recessed on the southwest side of the hill and two meter-diameter parabolic dish antennas oriented 220 degrees. The antennas are on either side of a clearing in front of the operations/control building. The adjacent support area includes one revetted building, one adit, and one messhall/barracks.

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18. (TSU) **Tung-shih Troposcatter Station** (Figure 11) is 9.7 km north-northeast of Tung-shih on Hainan Island. It consists of a hilltop operations/control area and a nearby support area. The operations/control area includes one multistory control building, one support building, and two meter-diameter parabolic dish antennas oriented toward Zhanjiang Troposcatter Station. The support area is 0.7 km northeast of the control area and comprises one administration building, three barracks, one messhall, and two support buildings. The Tung-shih station is cable-connected to Tung-shih Army Barracks AL 2, which is 1.7 km north of Tung-shih. This station, probably one of the most important on Hainan Island, has direct communications to the mainland.

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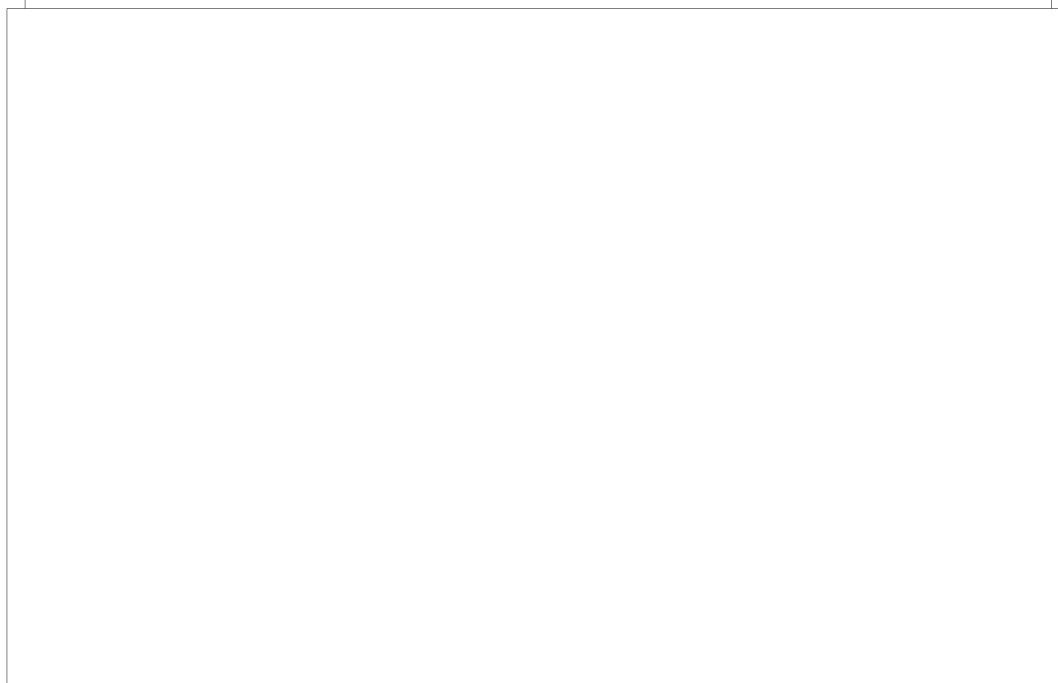
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19. (S/WN) **Zhanjiang Troposcatter Station** (Figure 12), 12 km southwest of Zhanjiang, consists of a road-served, wall-secured communications facility. It includes one multistory operations/control building, one administration building, two multistory barracks, one messhall, seven support buildings, two []-diameter parabolic dish antennas, and two []-diameter parabolic dish antennas. The two large [] antennas are oriented [] toward Guangzhou Troposcatter Station, and the two [] antennas are oriented 195 degrees toward Tung-shih Troposcatter Station on Hainan Island. Zhanjiang is a typical example of a troposcatter communications network relay station. The antennas are mounted in pairs of the same size and separated for space diversity. This station is an important link in the troposcatter communications network between Hainan Island and mainland China. The [] meter antennas operate in a mixed configuration with the []-diameter antennas at Tung-shih. The Chinese usually install the same size antennas at both ends of the same segment. Thus, the [] antennas at Zhanjiang will probably be replaced with antennas similar to the [] antennas at Tungshih.

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FIGURE 12. ZHANJIANG TROPOSCATTER STATION

20. (TSU) **Guangzhou Troposcatter Station** (Figure 13), 11.5 km southeast of Lung-kuei-shih, consists of a road-served, mountaintop troposcatter station with a small support area in the valley below. The mountaintop operations control area includes a multistory operations/control building and two [] meter-diameter parabolic dish antennas oriented 235 degrees toward Zhanjiang Troposcatter Station. The support area for the Guangzhou station is 0.7 km north of the control area and comprises seven assorted support buildings. This station is considered to be a terminal and is probably linked by landline to the Chinese mountaintop radrel communications network. Guangzhou Radrel Station North [] would be the best possible interconnection with the troposcatter network. It is close to the troposcatter station, and at one time possessed []-diameter troposcatter antennas. Guangzhou Troposcatter []

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21. (S/WN) **Nan-yueh-met Radcom Station North** [REDACTED] and **Nanyue Troposcatter Station North** (Figure 14) are 5.7 km north of Nan-yueh-met. The road-served mountaintop radrel and troposcatter stations are divided into separate control areas 1.7 km apart. Until 1981, the two areas were considered to be one target—Nan-yueh-met Radcom Station North. This station includes four bunkered [REDACTED] diameter parabolic dish antennas (probable Hungarian PM-24/28s) mounted in pairs oriented [REDACTED] degrees, seven assorted support buildings, one weather station, and one horizontal dipole antenna. A road connects the radcom station to the troposcatter station. In addition, the identification of cable scars between the radcom station and the troposcatter station suggests that the troposcatter station is linked to the national radrel system. Nanyue Troposcatter Station North comprises a control building, an extensive underground complex with two visible adits, two [REDACTED] diameter parabolic dish antennas oriented [REDACTED] two large concrete platforms (for additional parabolic dish antennas), and excavations for two more large antennas. The two parabolic dish antennas are oriented toward Gulin in the Guangzhou MR. (The Gulin corresponding station is unknown.) The concrete platforms are large enough to support troposcatter antennas oriented toward the Li-chia-chai Troposcatter Station. The excavations, located on the opposite side of the hill from the large troposcatter antennas, could support a projected troposcatter network into the Wuhan MR, and eventually connect with the large Nanjing Troposcatter Station, which is under construction. These two stations illustrate the Chinese attempt to link two separate national communications networks.

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22. (S/WN) **Nanjing Troposcatter Station** (Figure 15), 27.8 km south of Nanjing, consists of a large troposcatter station and a centrally located, probably hardened communications command bunker. Nanjing, the largest and most complex troposcatter station in China, is capable of transmitting in ranges of 700 to 800 km. The station contains two billboard-type troposcatter antennas oriented 330 degrees toward Dongping Troposcatter Station in the Jinan MR; a large probable control bunker under construction; a double-bay, reinforced, concrete probable command bunker under construction; and footings for two additional antennas which will be oriented toward the Wuhan MR. It also contains a support area of warehouses, barracks, and covered vehicle sheds. The entire complex is under construction. The two antennas and bunkered support facilities are 90 percent externally complete, and the hardened, double-walled communications command bunker is externally complete. A third possible operational area, just east of the command bunker, consists of a cleared area capable of supporting two large parabolic dish antennas which probably will be oriented toward Shanghai.

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23. (S/WN) **Fangshan Radcom and Troposcatter Station** (Figure 16) is 3.5 km west of Fangshan. It consists of a road-served, mountaintop troposcatter station containing one diameter parabolic dish antenna oriented 225 degrees, one control building, and two support buildings. In 1972, the station had been equipped with two antennas, but both were removed in 1976. In January 1981, one antenna was reinstalled.

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24. (S/WN) **Li-chia-chai Troposcatter Station** (Figure 17), in the center of Li-chia-chai, consists of two -diameter parabolic dish antennas which are 1,000 meters apart and oriented 340 degrees. The 340-degree orientation has no known corresponding station.

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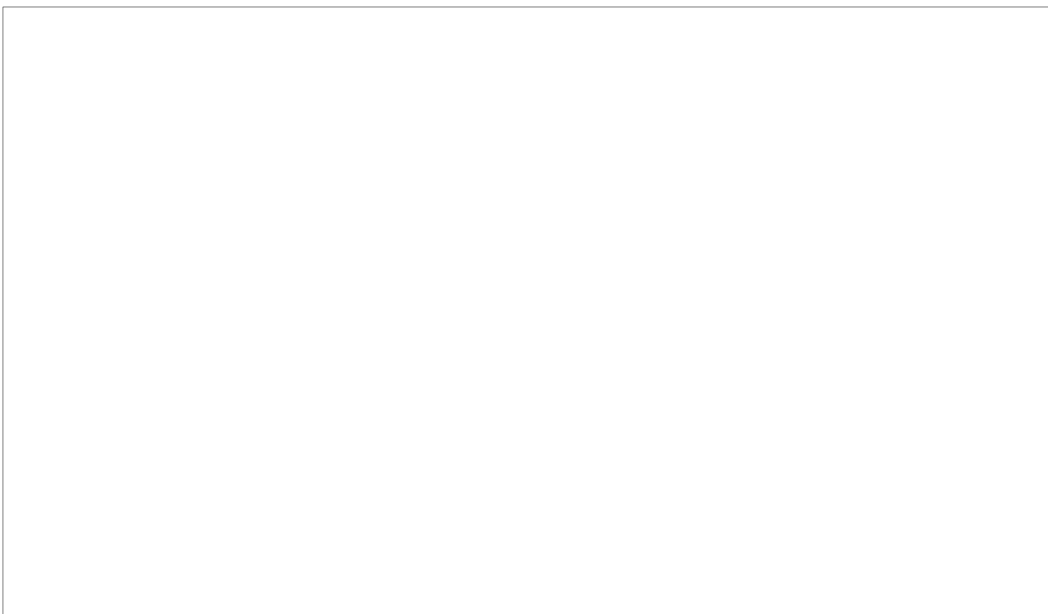
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25. (TSZU) **Xining Troposcatter Station** (Figure 18) is 20 km west-southwest of Xining. It consists of an isolated, road-served, hilltop troposcatter station containing one rectangular control building and two -diameter parabolic dish antennas oriented toward the city of Lanzhou. Sigint confirmed 2-GHz signals emitting from Xining between May and June 1979.³

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26. (S/WN) **Dongping Troposcatter Station** (Figure 19), 16 km north of Dongping, consists of an isolated, road-served, hilltop troposcatter station. The station contains two diameter parabolic dish antennas mounted on stationary steel lattice supports and oriented 155 degrees. The probable corresponding station is Nanjing Troposcatter Station, under construction 525 km south-southeast of Dongping. In addition to the antennas at Dongping, the station contains two operations buildings, one control building, one probable maintenance building, three support buildings, and a clearing on the opposite side of the complex capable of supporting two more large antennas oriented northeast toward Jinan Troposcatter Station.

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27. (S/WN) **Mashenqiao Troposcatter Station** (Figure 20) is on a ridgeline 10 km north of Mashenqiao and consists of an isolated troposcatter communications relay station and a support area in the valley below. The troposcatter station contains four []-diameter parabolic dish antennas mounted in pairs; antenna orientations are 155 and 070 degrees. In addition, the ridgeline station includes two control buildings, one operations building, and four support buildings. Jinghou Troposcatter Station Northeast is the corresponding station for the 070-degree orientation. []

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Previously Identified Troposcatter Stations

28. (TSZ) In addition to the troposcatter stations that are complete or nearly complete, four facilities previously identified as troposcatter stations are located at Hekou, Lushun, Anyang, and Pingdingshan (Table 2). These facilities are not considered to be active troposcatter communications stations; however, at one time the first three — Hekou, Lushun, and Anyang — did contain antennas similar to troposcatter antennas at other facilities. One facility, Hekou Troposcatter Station, used the Chinese transportable troposcatter communications unit on imagery of []. However, the transportable unit has not been observed on imagery since 1976. The fourth station, Pingdingshan Probable Troposcatter Station, now contains one 6-meter parabolic dish antenna and includes a clearing nearby to accommodate a second antenna. []

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Table 2.

Previously Identified Troposcatter Stations

This table in its entirety is classified TOP SECRET ZARF UMBRA

Name/BE No/Coordinates	Type of Antenna/Orientation	Remarks	
Hekou Troposcatter Station [] 38-50-15N 121-29-50E	No tropo present	Previously reported antennas removed in 1976; old site remains inactive but usable	25X1
Lushun Troposcatter Station Northwest [] 38-49-24N 121-11-43E	One [] cut-parabolic dish 160 degrees	Poss coastal defense radar rather than tropo or communications	25X1 25X1
Anyang Infantry Division Hq Troposcatter Station [] 36-08-08N 114-21-02E	No tropo present	Previously reported antennas removed in 1973	25X1
Pingdingshan Probable Troposcatter Station [] 33-46-55N 113-18-00E	One [] parabolic dish 160 degrees	Grading for additional antenna ucon	25X1 25X1

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Imagery Analyst's Comments

29. (TSZU) There are indications suggesting that additional troposcatter stations will be constructed to complete the network in the next few years. At present, the Chinese have linked the troposcatter stations with other national communications networks such as the mountaintop radrel facilities and probably the national buried cable network (Figure 21). [REDACTED]

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[REDACTED] In the past, the Chinese have methodically used [REDACTED] diameter parabolic dish antennas to test site locations. After determining the best site location, [REDACTED] diameter parabolic dish antennas for permanent troposcatter communications were installed. Parabolic dish antennas do not have to be the same size to operate together (station to station), but in most cases, the Chinese have matched the antenna sizes throughout the country.

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30. (TSZ) Construction of troposcatter stations meets two current needs: first, a cost-efficient method for extending existing long-range communication networks, and second, a high-capacity, redundant communications system (if the troposcatter network is completed). Communication by troposcatter network also provides command and control flexibility. A highly transportable, high-capacity communications unit deployed with forward elements defending Chinese borders would extend the General Staff Department (GSD) military command and control to the division commanders as required.² This would comply with the strict communications security and austerity program of constructing only necessary units (mobile or fixed) in China.

REFERENCES**IMAGERY**

(S/WN) All applicable satellite imagery acquired from [REDACTED] was used in the preparation of this report.

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DOCUMENTS

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[REDACTED] 25X1
8. 2000-Mc Over-the-Horizon Communication Systems, Nippon Electric Company, 26 Jun 75 (UNCLASSIFIED)
9. NPIC. [REDACTED] PIN-062/72, Probable Mobile Troposcatter Antenna, Ha-erh-pin, China, May 72 (TOP SECRET R) 25X1

*Extracted information is classified TOP SECRET Z.

**Extracted information is classified TOP SECRET Z-U.

***Extracted information is classified SECRET.

†Extracted information is classified SECRET
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REQUIREMENT

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Project 542086C

(S) Comments and queries regarding this report are welcome. They may be directed to [REDACTED] Asian Forces Division, Imagery Exploitation Group, NPIC, [REDACTED]

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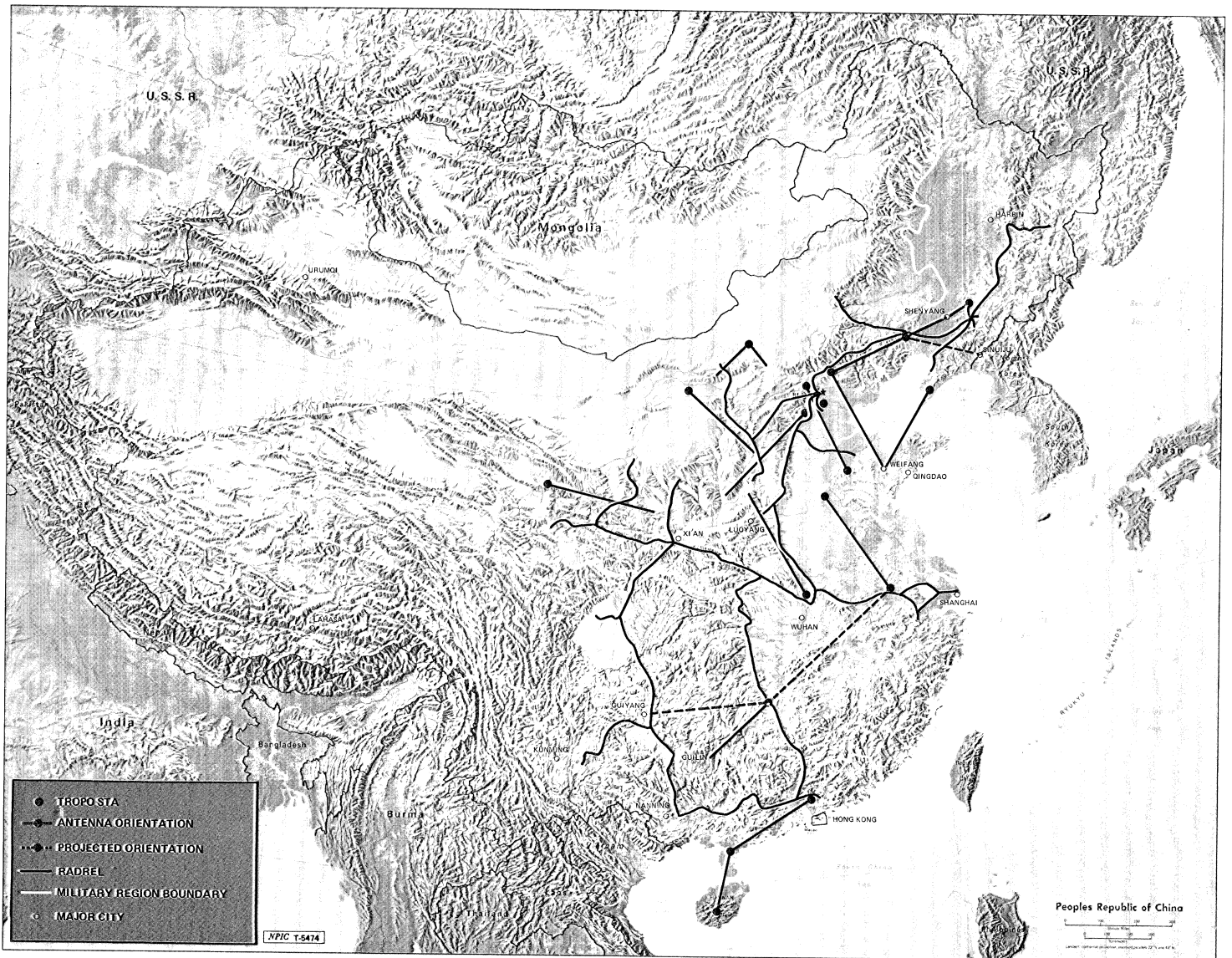
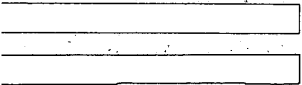


FIGURE 21. CHINESE NATIONAL RADREL AND TROPOSCATTER NETWORK

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